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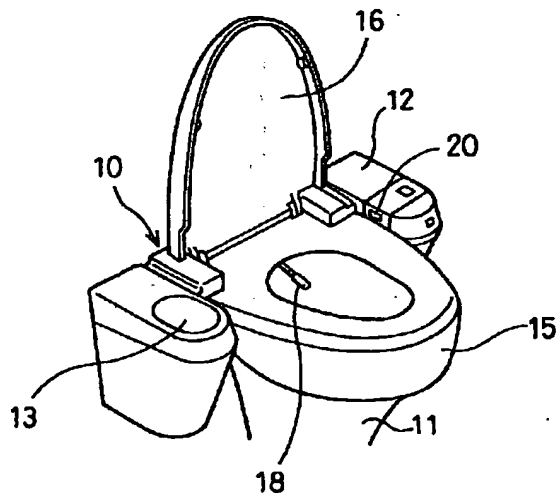
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(54)【発明の名称】 赤外線反射式センサ及びこれを用いた便器

(57)【要約】

【課題】 着座センサ20は、保護板24に近い位置にある検知対象物を検出することができ、保護板24の反射の影響をなくし検知精度を高める。

【解決手段】 着座センサ20は、発光素子22と、受光素子23と、保護板24とを備えており、発光素子22から発せられる赤外光の投光エリアR1と、受光素子23が受光する範囲を受光エリアR2とし、これらが重なる範囲を感知エリアR3としている。保護板24の透過部25は、感知エリアR3に重なるように配置されている。また、保護板24は、その内表面25a及び外表面25bでの反射光が受光素子23に向かわないようにセンサ基板21に対して角度 $\theta k$ で傾いて配置されている。



## 【特許請求の範囲】

【請求項1】 赤外光を発する発光素子と、この発光素子から離れて設置された受光素子と、光透過性の材料からなり受光素子及び発光素子から離れて設置され該受光素子及び発光素子を保護するための保護部材とを備え、上記発光素子から発せられかつ保護部材を通った赤外光のうち検知対象物で反射した反射光を上記受光素子で受光することにより、該検知対象物を検知する赤外線反射式センサにおいて、

上記発光素子は、その中心から第1角度の範囲で広がる赤外光が発せられる投光エリアを形成するように配置され、

上記受光素子は、その中心から第2角度の範囲の赤外光を受光する受光エリアを形成するとともに、該受光エリアと上記投光エリアとが重なる領域を感知エリアとしたとき、該感知エリア内に上記検知対象物があるときに反射光を受光するように配置され、

上記保護部材は、上記発光素子から発する赤外光が透過する透過部を備え、該透過部は、少なくともその一部が上記感知エリア内に入るように配置されるとともに、該透過部で反射される赤外光が上記受光素子側へ向かわないように構成されていること、  
を特徴とする赤外線反射式センサ。

【請求項2】 請求項1において、  
上記透過部は、該透過部で反射される赤外光が受光素子側へ向かわない角度で配置された板材である赤外線反射式センサ。

【請求項3】 請求項1において、  
上記透過部は、上記発光素子側である内側の表面が該発光素子を中心にして半球面に形成されている赤外線反射式センサ。

【請求項4】 請求項1または請求項2において、  
上記透過部は、上記発光素子と反対側である外側の表面が該発光素子を中心にして半球面に形成されている赤外線反射式センサ。

【請求項5】 赤外光を発する発光素子と、この発光素子から離れて設置された受光素子と、光透過性の材料からなり受光素子及び発光素子から離れて設置され該受光素子及び発光素子を保護するための保護部材とを備え、上記発光素子から発せられた赤外光のうち検知対象物で反射した反射光を上記受光素子で受光することにより、該検知対象物を検知する赤外線反射式センサにおいて、  
上記発光素子は、その中心から第1角度の範囲で広がる赤外光が発せられる投光エリアを形成するように配置され、

上記受光素子は、その中心から第2角度の範囲の赤外光を受光する受光エリアを形成するとともに、該受光エリアを上記投光エリアに重なる感知エリアとし、該感知エリア内に上記検知対象物があるときに反射光を受光するように配置され、

上記保護部材は、上記発光素子から発する赤外光が透過する透過部を備え、該透過部は、少なくともその一部が上記感知エリア内に入るように配置されるとともに、上記透過部と受光素子との間に上記透過部と同じ屈折率の材料から形成された充填材を備えたこと、

を特徴とする赤外線反射式センサ。

【請求項6】 人体の局部に向けて洗浄水を噴出する衛生洗浄装置を備え、該衛生洗浄装置による洗浄水の噴出指令を制御するための着座センサに上記請求項1ないし請求項5のいずれかの赤外線反射式センサを用いたことを特徴とする便器。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、洋式便器への着座の有無を検知する着座センサなどに使用される赤外線反射式センサ及びこれを用いた便器に関する。

【0002】

【従来の技術】従来、この種の赤外線反射式センサとして、赤外光を発する発光素子と、赤外光を受光する受光素子とを備え、該発光素子から発せられる赤外光が検知対象物に反射され、その反射光を受ける受光素子の検知信号に基づいて検知対象物の有無を検知するセンサが知られている（特開平6-101260号公報）。

【0003】図14は赤外線反射式センサ100を示す概略構成図である。図14において、赤外線反射式センサ100は、ケーシング102と、このケーシング102に形成された収納凹所104に収納された発光素子106と、上記ケーシング102に形成された収納凹所108に収納された受光素子110と、ケーシング102に対して距離L1だけ離して設置された保護板112とを備えている。上記保護板112は、光透過性のアクリル板から形成されており、発光素子106や受光素子110などの内部部品の保護や外観の向上を図っている。

【0004】上記赤外線反射式センサ100では、発光素子106を中心に角度 $\theta 1$ で発せられる範囲が投光エリアR1となり、受光素子110を中心とした角度 $\theta 2$ の範囲が受光エリアR2となっている。そして、投光エリアR1と受光エリアR2とが重なる領域を感知エリアR3（破線で示す部分）とし、感知エリアR3内に検知対象物Tが入ると、発光素子106からの光は、経路g1を経て検知対象物Tの表面で乱反射して、経路g2を経て受光素子110に入る。このとき、受光素子110からの検知信号が所定以上になると検知対象物Tがあると判定している。

【0005】しかし、上記赤外線反射式センサ100では、図15に示すように、検知対象物Tが感知エリアR3より保護板112側に近接した位置にあり、つまり感知エリアR3から外れると、発光素子106からの赤外光のうちもつとも受光素子110を通る赤外光、つまり経路g3から経路g4を経る赤外光であっても、受光素

子110に入らず、検知対象物Tを検知することができない。

【0006】これを解決するために、図16に示すように、保護板120を発光素子106及び受光素子110から距離L2まで離して、保護板120を感知エリアR3にかかるように配置する手段がある。

【0007】

【発明が解決しようとする課題】しかし、保護板120を距離L2まで遠くすると、設置スペースが大きくなるという問題があるだけでなく、発光素子106から発した赤外光のうち経路g5を経た赤外光が保護板120の反射点p1で反射して、経路g6を経て受光素子110に入射する。このため、検知対象物Tが感知エリアR3内にないにもかかわらず、検知対象物Tを誤って検知するという問題があった。

【0008】本発明は、上記従来の技術の問題を解決するものであり、発光素子及び受光素子に近接した位置にある検知対象物を検知することができるとともに、検知対象物の検知精度を向上させた赤外線反射式センサ及びこれを用いた便器を提供することを目的とする。

【0009】

【課題を解決するための手段およびその作用・効果】上記課題を解決するためになされた請求項1の発明は、赤外光を発する発光素子と、この発光素子から離れて設置された受光素子と、光透過性の材料からなり受光素子及び発光素子から離れて設置され該受光素子及び発光素子を保護するための保護部材とを備え、上記発光素子から発せられかつ保護部材を通った赤外光のうち検知対象物で反射した反射光を上記受光素子で受光することにより、該検知対象物を検知する赤外線反射式センサにおいて、上記発光素子は、その中心から第1角度の範囲で広がる赤外光が発せられる投光エリアを形成するように配置され、上記受光素子は、その中心から第2角度の範囲の赤外光を受光する受光エリアを形成するとともに、該受光エリアと上記投光エリアとが重なる領域を感知エリアとし、該感知エリア内に上記検知対象物があるときに反射光を受光するように配置され、上記保護部材は、上記発光素子から発する赤外光が透過する透過部を備え、該透過部は、少なくともその一部が上記感知エリア内に入るように配置されるとともに、該透過部で反射される赤外光が上記受光素子側へ向かわないように構成されていること、を特徴とする。

【0010】第1の発明では、発光素子は、その中心から第1角度の範囲で赤外光を発して、その範囲を投光エリアとするように配置されており、また、受光素子は、その中心から第2角度の範囲の赤外光を受光する受光エリアを形成するように配置されている。そして、投光エリアと受光エリアとが重なる範囲が感知エリアとなっており、該感知エリアに検知対象物があると、発光素子で発した赤外光は、検知対象物で乱反射して受光素子で受

光される。これにより、検知対象物が検知される。

【0011】また、保護部材は、発光素子及び受光素子から離れて配置されて発光素子及び受光素子を保護しているが、光透過性の材料で形成されているので、発光素子からの赤外光を通すための検知対象物の検知の妨げとならない。また、保護部材は、感知エリアの一部にかかるように配置されているので、該保護部材に近接した位置に検知対象物があっても、これを検知することができる。

10 【0012】さらに、保護部材は、発光素子から発する赤外光が透過する透過部を備え、この透過部は、該透過部で反射される赤外光が受光素子側へ向かわないように形成されている。したがって、発光素子から発した赤外光が透過部で反射することがなく、つまり検知対象物以外で反射した赤外光が受光素子で入らないから、受光素子から誤った検知信号が出力されることがない。

【0013】なお、保護部材の透過部の好適な態様として、保護部材を板材で形成し、この保護部材を傾斜した角度に設置する構成とすることにより実現できる。

20 【0014】また、透過部の他の好適な態様として、透過部の表面を、発光素子を中心にして半球面に形成する。これにより、透過部の表面で反射した赤外光は、発光素子へ戻り、受光素子側へ向かわない。

【0015】第2の発明は、保護部材の透過部と発光素子との間に、透過部とほぼ同じ屈折率の材料から形成された充填材を設けたものであり、充填材は、透過部とほぼ同じ屈折率を有しているから、透過部の表面で反射が生じることがなく、その影響に伴う誤った検出結果を生じない。

30 【0016】なお、本発明にかかる赤外線反射式センサは、各種のものに適用することができるが、例えば、人体の局部に向けて洗浄水を噴出する衛生洗浄装置において、その洗浄水の噴出指令を制御するための検出信号を出力する着座センサに用いることができる。この着座センサは、人体との接触を防止するために保護部材を使用しているから好適に適用できる。

【0017】

【発明の実施の形態】以上説明した本発明の構成・作用を一層明らかにするために、以下本発明の好適な実施例について説明する。

40 【0018】図1は本発明の一実施の形態に係る赤外線反射式センサを着座センサとして利用した衛生洗浄装置付き洋式便器の外観図である。図1に示すように、衛生洗浄装置10は、洋式便器11に装着されるものであり、ケース本体12と、ケース本体12の袖部に設けられた操作部13と、ケース本体12に回転自在に支持された便座15及び便蓋16と、温水を吐水する洗浄用ノズル18と、を備えている。

【0019】また、衛生洗浄装置10のケース本体12の内側部には、着座センサ20が取り付けられている。

この着座センサ20は、赤外線反射式センサであり、便座15に人が着座したときに検知信号を出力するものである。この検知信号は、たとえば、洗浄用ノズル18から洗浄水の噴出を許可する信号として使用される。

【0020】図2は着座センサ20を示す概略構成図、図3及び図4はその検知動作を説明する説明図である。図2において、着座センサ20は、センサ基板21と、発光素子22と、受光素子23と、保護板24とを主要な構成としている。センサ基板21には、収納凹所26及び収納凹所27が形成されており、上記収納凹所26

内に発光素子22が設置され、上記収納凹所27に受光素子23が設置されている。

【0021】上記収納凹所26は、収納凹所27より深く形成されるとともに、該収納凹所26の開口26a及び収納凹所27の開口27aは、保護板24とほぼ平行であり、センサ基板21の底面21aに対して角度 $\theta_k$ で傾斜している。

【0022】また、上記保護板24は、アクリル樹脂からなる光透過性の板材であり、発光素子22からの赤外光を乱反射させないように平滑な面となっており、赤外光が透過する透過部25を有している。

【0023】上記着座センサ20において、発光素子22が赤外光を発する投光エリアR1は、発光素子22の中心点Cpaを中心にして開口26aから角度 $\theta_a$ で広がる範囲であり、一方、受光素子23が受光する受光エリアR2は、受光素子23の点Cpbを中心にして開口27aから角度 $\theta_b$ で広がる範囲である。そして、投光エリアR1と受光エリアR2とが重なる範囲が図2の破線で表される感知エリアR3で表わされる。上記保護板24は、感知エリアR3の一部を含むように配置されて

いる。

【0024】図5は着座センサ20の検知回路30を示すブロック図である。図5において、着座センサ20の検知回路30の動作を説明する。いま、駆動回路31より発光素子22に電力が連続的または周期的に供給され、発光素子22より赤外光が発せられる。このとき、感知エリアR3（図2参照）内に検知対象物Tがあると、赤外光は反射して受光素子23に入射される。受光素子23は、入射された光の強さに応じて微弱な電気信号を出力する。この電気信号は、増幅回路32で増幅されて比較器33の一方の入力端子に入力される。比較器33の他方の端子には、基準電圧回路34の基準電圧が入力される。比較器33は、検知信号が上記基準電圧を上回ったときにハイレベルの信号を出力することで、検知対象物Tを検知する。

【0025】次に、着座センサ20による検知動作について説明する。図3において、検知対象物T1が感知エリアR3内にあると、発光素子22からの赤外光は、検知対象物T1で乱反射して、その一部の反射光が受光素子23に入り、受光素子23で電気信号に変換される。

受光素子23からの電気信号は、図5で説明した検知回路30により電気的に処理されて検知対象物T1が検知される。

【0026】また、保護板24が感知エリアR3の一部を横切るように配置されており、保護板24に近接した位置も感知エリアR3となっている。したがって、保護板24の付近に検知対象物T2が位置する、いわゆる近点検知も行なうことができる。

【0027】次に、発光素子22からの赤外光が保護板24で反射することに伴う検知動作の影響について説明する。図4において、発光素子22から発する赤外光は、保護板24上の内表面25aのうち投光エリアR1と重なりあう反射面F1で反射する。この反射面F1のうち受光素子23に近い点P1が発光素子22へ一番近づく経路G1となる。ここで、保護板24の内表面25aは、十分に滑らかであり乱反射しないとすると、経路G1を経た赤外光は、点P1における法線Laに対して、入射角 $\theta_{in1}$ と等しい反射角 $\theta_{out1}$ で反射する。

【0028】ここで、反射角 $\theta_{out1}$ は、受光素子23に対して離れる方向が正となるように、つまり、経路G1と反射面F1とのなす角度 $\alpha_1$ が $90^\circ$ 以上となるように、保護板24が角度 $\theta_k$ で傾斜して配置されている。

【0029】したがって、反射面F1上の点P1で反射した赤外光は、受光素子23から離れた方向へ向かう。同様に、赤外光が経路G2を経て、受光素子23より離れた反射面F1における点P2で反射すると、角度 $\alpha_2$ が $90^\circ$ より大きくなるから受光素子23に対していっそう離れた方向へ向かう。このように、発光素子22から発した赤外光は、受光素子23に向かうことがなく、誤った検知動作を行わない。なお、保護板24の外表面25bにおける反射も、内表面25aと同じであるから、その影響はない。

【0030】図6は第2実施の形態にかかる着座センサ20Bを示す構成図である。図6において、着座センサ20Bは、センサ基板21B及び保護板24Bの形状が異なる点以外は、第1実施の形態と同じ構成である。すなわち、センサ基板21Bでは、発光素子22を収納する収納凹所26Bと、受光素子23を収納する収納凹所27Bとが同じ形状であり、つまり収納凹所26Bと収納凹所27Bの深さ及び開口26Ba及び開口27Baの形状が同じであり、その間の隔壁部28を中心に対称になっている。このような着座センサ20Bの構成により、投光エリアR1及び受光エリアR2は、角度 $\theta_a$ で同じ形状であり、感知エリアR3は、投光エリアR1と受光エリアR2の中央部に形成される。

【0031】また、上記保護板24Bは、センサ基板21Bの底面21aと平行に配置されている。上記保護板24Bのうち発光素子22に対向する部分であって、感知エリアR3と重なる部分は、透過部25Bになってい

る。すなわち、透過部25Bの内表面25Ba及び外表面25Bbは、発光素子22の中心点Cpaを中心した半球面になっている。

【0032】次に、着座センサ20Bの検知動作について説明する。図7において、検知対象物T1が感知エリアR3内にあると、発光素子22からの赤外光は、経路G3で示すように保護板24Bの透過部25Bを透過した後に、検知対象物T1の表面で乱反射し、再度、保護板24Bを通過して受光素子23に入射する。これにより、検知対象物Tが着座センサ20Bにより検知される。

【0033】このように発光素子22からの赤外光は、保護板24Bの透過部25Bを直進するが、図8に示すように、その一部が保護板24Bの内表面25Baで反射する。しかし、透過部25Bの内表面25Baは、発光素子22の中心点Cpaを中心した半球面であるから、透過部25Bで反射するすべての反射光は、発光素子22に向かう。したがって、保護板24Bで反射する反射光は、受光素子23に入射されることがなく、誤った検知結果を生じない。

【0034】なお、図6などを用いて説明した第2実施の形態では、保護板24Bの透過部25Bを半球面に形成したが、これに限らず、図9に示す第3実施の形態にかかる着座センサ20Cであってもよい。つまり、着座センサ20Cの保護板24Cの透過部25Cは、反射光を受光素子23に向かわせないように反射させればよいことから、透過部25Cの受光素子23側の一部だけを球面状としてもよい。

【0035】次に、第4実施の形態にかかる図10及び図11に示す着座センサ20Dについて説明する。図10において、着座センサ20Dのセンサ基板21Dは、図6の第2実施の形態と同じであるが、保護板24Dの形状が異なっている。すなわち、保護板24Dは、その板厚tDが図6の保護板24Bより厚くして赤外光の減衰量を大きくしているとともに、透過部25Dの形状を異にしている。すなわち、保護板24Dは、やや厚めの光透過性のアクリル板を用いて、透過部25Dの内表面25Daを切削して半球面状の凹面としている。

【0036】ここで、検知対象物の検知動作は、上述した第1実施の形態と同じであるので、保護板24Dでの反射の影響について説明する。保護板24Dの内表面25Daにおいて、発光素子22からの赤外光は、すべて発光素子22へ向かい、受光素子23へ入射されることがない。一方、保護板24Dの外表面25Dbにおいて、発光素子22からの赤外光の一部が反射して、受光素子23に向かう。しかし、赤外光は、保護板24D内で経路u1、u2を通過した際に、その経路u1、u2が長いから減衰量が大きく、受光素子23に向かう光量がきわめて小さくなる。したがって、保護板24Dの外表面25Dbによる反射光の影響がない。なお、検知対

象物から反射される赤外光の光量は、透過部25Dの外表面25Dbで反射される光量よりも大きいので、透過部25Dの減衰に伴う検知動作に支障がない。

【0037】次に、第5実施の形態にかかる図12及び図13に示す着座センサ20Eについて説明する。図12において、着座センサ20Eは、保護板24Eの形状と、センサ基板21Eと保護板24Eとの間のスペースに充填材29を充填した構成が上述した実施の形態と異なっている。すなわち、保護板24Eの透過部25Eの外表面25Ebは、半球状になっている。また、上記充填材29は、保護板24Eと同じ屈折率の光透過性の材料（例えば、アクリル樹脂、 ）から形成されている。

【0038】上記着座センサ20Eによれば、透過部25Eの外表面25Ebが発光素子22の中心点Cpaを中心とした半球面となっており、その外表面25Dbでの反射光はすべて発光素子22に向かい、受光素子23に向かわないことから、透過部25Eの外表面25Ebでの反射の影響はない。

【0039】一方、透過部25Eの内表面25Ea側のスペースには、充填材29が充填されており、この充填材29の材料は、保護板24Eと同じ屈折率の材料である。このため、透過部25Eの内表面25Eaで赤外光が反射せず、受光素子23に向かわないから、その影響がない。なお、充填材29は、発光素子22及び受光素子23を含めた保護板24Eのスペースのすべてに充填するほか、受光素子23へ向かう経路の周辺だけに充填してもよい。

【0040】なお、この発明は上記実施例に限られるものではなく、その要旨を逸脱しない範囲において種々の態様において実施することが可能である。

【図面の簡単な説明】

【図1】本発明の一実施の形態にかかる赤外線反射式センサを着座センサ20に用いた衛生洗浄装置10を示す斜視図。

【図2】第1実施の形態にかかる着座センサ20を説明する説明図。

【図3】着座センサ20の検知動作を説明する説明図。

【図4】保護板24の反射光の影響を説明する説明図。

【図5】着座センサ20の検知回路30を説明するブロック図。

【図6】第2実施の形態にかかる着座センサ20Bを説明する説明図。

【図7】着座センサ20Bの検知動作を説明する説明図。

【図8】保護板24Bの反射光の影響を説明する説明図。

【図9】第3実施の形態にかかる着座センサ20Cを説明する説明図。

【図10】第4実施の形態にかかる着座センサ20Dを

説明する説明図。

【図11】保護板24Dの反射光の影響を説明する説明図。

【図12】第5実施の形態にかかる着座センサ20Eを説明する説明図。

【図13】保護板24Eの反射光の影響を説明する説明図。

【図14】従来の赤外線反射式センサ100を説明する説明図。

【図15】赤外線反射式センサ100の課題を説明する説明図。

【図16】従来の他の赤外線反射式センサ100Pを説明する説明図。

【符号の説明】

T, T1, T2…検知対象物

F1…反射面

R1…投光エリア

R2…受光エリア

R3…感知エリア

10…衛生洗浄装置

11…洋式便器

12…ケース本体

13…操作部

15…便座

16…便蓋

18…洗浄用ノズル

20…着座センサ

20, 20B~20E…着座センサ

21, 21B~21E…センサ基板

21a…底面

22…発光素子

23…受光素子

24, 24B~24E…保護板

25, 25B~25E…透過部

25a, 25Ba, 25Da, 25Ea…内表面

25b, 25Bb, 25Db, 25Eb…外表面

26, 26B…収納凹所

26a, 26Ba…開口

27, 27B…収納凹所

27a, 27Ba…開口

28…隔壁部

29…充填材

30…検知回路

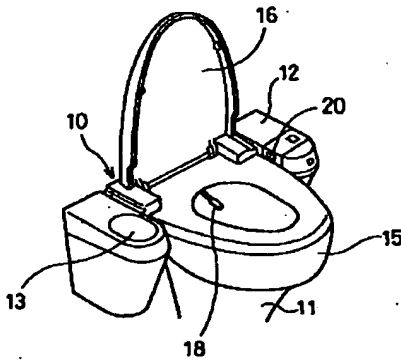
20 31…駆動回路

32…増幅回路

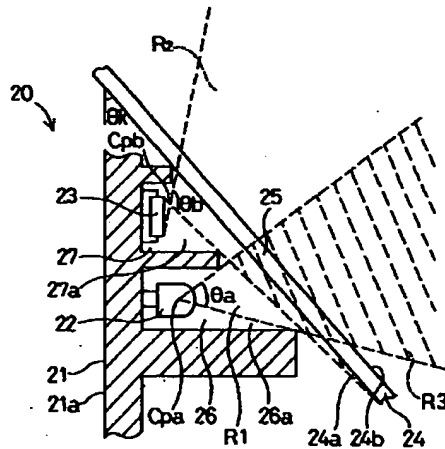
33…比較器

34…基準電圧回路

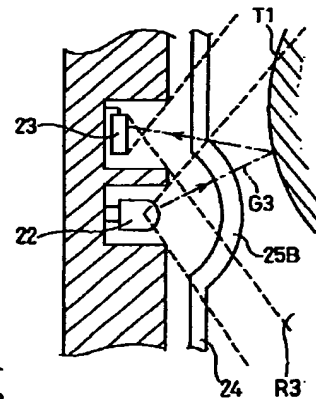
【図1】



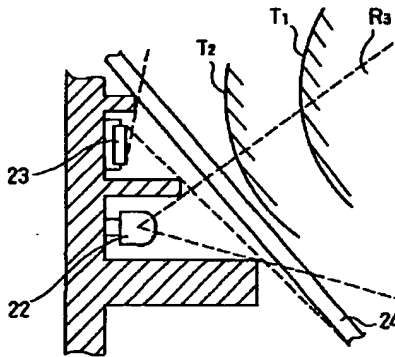
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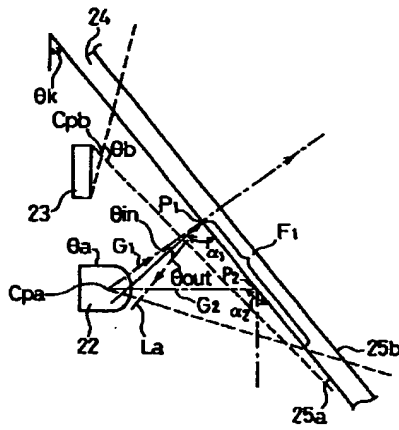
【図7】



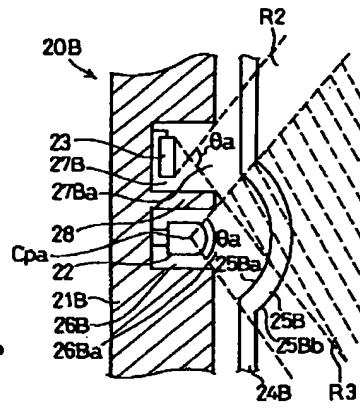
【図3】



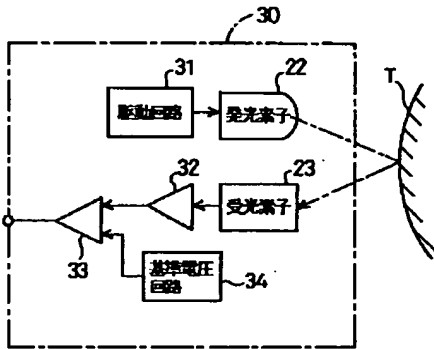
【図4】



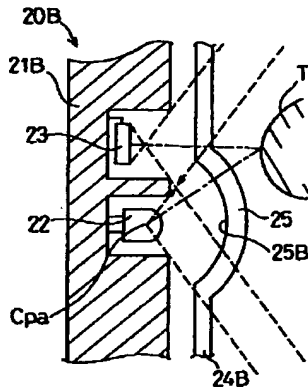
【図6】



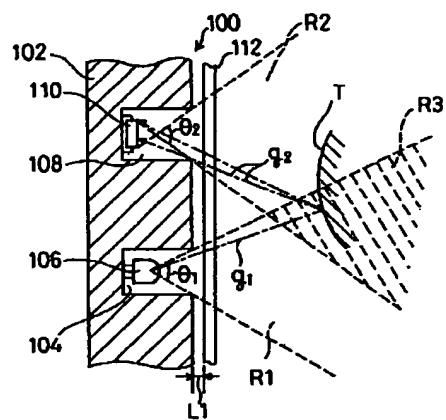
【図5】



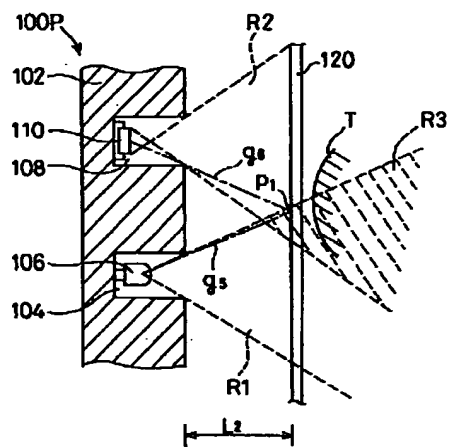
【図8】



【图14】



【例 16】





## CLAIMS

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[Claim(s)]

[Claim 1] The light emitting device which emits infrared light, and the photo detector left and installed from this light emitting device, It has a protection member for consisting of an ingredient of light transmission nature, being separated and installed from a photo detector and a light emitting device, and protecting this photo detector and a light emitting device. By receiving the reflected light reflected with the detection object among the infrared light which was emitted from the above-mentioned light emitting device, and passed along the protection member by the above-mentioned photo detector In the infrared reflective type sensor which detects this detection object the above-mentioned light emitting device It is arranged so that the floodlighting area where the infrared light which spreads in the range of the 1st include angle from the core is emitted may be formed. The above-mentioned photo detector While forming the light-receiving area which receives the infrared light of the range of the 2nd include angle from the core It is arranged so that the reflected light may be received when the field with which this light-receiving area and the above-mentioned floodlighting area lap is made into sensing area, and the above-mentioned detection object is in this sensing area. The above-mentioned protection member It has the transparency section which the infrared light emitted from the above-mentioned light emitting device penetrates. This transparency section The infrared reflective type sensor characterized by being constituted so that the infrared light reflected in this transparency section may not go to the above-mentioned photo detector side, while being arranged so that the part may enter in the above-mentioned sensing area at least.

[Claim 2] It is the infrared reflective type sensor which is the plate arranged at the include angle at which the infrared light in which the above-mentioned transparency section is reflected in this transparency section in claim 1 does not go to a photo detector side.

[Claim 3] It is the infrared reflective type sensor by which the inside front face whose above-mentioned transparency section is the above-mentioned light emitting device side in claim 1 is formed in the semi-sphere side focusing on this light emitting device.

[Claim 4] It is the infrared reflective type sensor by which the front face of the outside whose above-mentioned transparency sections are the above-mentioned light emitting device and the opposite side in claim 1 or claim 2 is formed in the semi-sphere side focusing on this light emitting device.

[Claim 5] The light emitting device which emits infrared light, and the photo detector left and installed from this light emitting device, It has a protection member for consisting of an ingredient of light transmission nature, being separated and installed from a photo detector and a light emitting device, and protecting this photo detector and a light emitting device. By receiving the reflected light reflected with the detection object among the infrared light emitted from the above-mentioned light emitting device by the above-mentioned photo detector In the infrared reflective type sensor which detects this detection object the above-mentioned light emitting device It is arranged so that the floodlighting area where the infrared light which spreads in the range of the 1st include angle from the core is emitted may be formed. The above-mentioned photo detector While forming the light-receiving area which receives the infrared light of the range of the 2nd include angle from the core This light-receiving area is made into the sensing

area which laps with the above-mentioned floodlighting area, and it is arranged so that the reflected light may be received, when the above-mentioned detection object is in this sensing area. The above-mentioned protection member It has the transparency section which the infrared light emitted from the above-mentioned light emitting device penetrates. This transparency section The infrared reflective type sensor characterized by having the filler formed from the ingredient of the same refractive index as the above-mentioned transparency section between the above-mentioned transparency section and a photo detector while having been arranged so that the part may enter in the above-mentioned sensing area at least.

[Claim 6] The toilet bowl characterized by using the infrared reflective type sensor of either above-mentioned claim 1 thru/or claim 5 for the taking-a-seat sensor for having the health washing station which spouts wash water towards the part of the body, and controlling the jet command of the wash water by this health washing station.

## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the toilet bowl using the infrared reflective type sensor and this which are used for the taking-a-seat sensor which detects the existence of taking a seat to a foreign style toilet bowl.

[0002]

[Description of the Prior Art] It has conventionally the light emitting device which emits infrared light, and the photo detector which receives infrared light as this kind of an infrared reflective type sensor, the infrared light emitted from this light emitting device is reflected by the detection object, and the sensor which detects the existence of a detection object based on the detection signal of the photo detector which receives that reflected light is known (JP,6-101260,A).

[0003] Drawing 14 is the outline block diagram showing the infrared reflective type sensor 100. The infrared reflective type sensor 100 is equipped with casing 102, the light emitting device 106 contained by the receipt hollow 104 formed in this casing 102, the photo detector 110 contained by the receipt hollow 108 formed in the above-mentioned casing 102, and the guard plate 112 with which only distance L1 was detached and installed to casing 102 in drawing 14. The above-mentioned guard plate 112 is formed from the acrylic board of light transmission nature, and is aiming at protection of internal components, such as a light emitting device 106 and a photo detector 110, and improvement in an appearance.

[0004] By the above-mentioned infrared reflective type sensor 100, the range emitted at an include angle  $\theta_1$  focusing on a light emitting device 106 serves as the floodlighting area R1, and the range of the include angle  $\theta_2$  centering on a photo detector 110 serves as the light-receiving area R2. And if the field with which the floodlighting area R1 and the light-receiving area R2 lap is made into the sensing area R3 (part shown with a broken line) and the detection object T enters in the sensing area R3, the light from a light emitting device 106 will be reflected irregularly on the front face of the detection object T through a path g1, and will go into a photo detector 110 through a path g2. At this time, if the detection signal from a photo detector 110 becomes more than predetermined, it will have judged with there being a detection object T.

[0005] However, even if it is the infrared light which passes along a photo detector 110 by the above-mentioned infrared reflective type sensor 100 most among the infrared light from a light emitting device 106 when it is in the location where the detection object T approached the guard-plate 112 side from the sensing area R3, that is, separates from the sensing area R3, as shown in drawing 15, i.e., the infrared light which passes through a path g4 from a path g3, it cannot go into a photo detector 110 and the detection object T cannot be detected.

[0006] In order to solve this, as shown in drawing 16, a guard plate 120 is detached from a light emitting device 106 and a photo detector 110 to distance L2, and there is a means to arrange a guard plate 120 so that the sensing area R3 may be started.

[0007]

[Problem(s) to be Solved by the Invention] However, if a guard plate 120 is made far to distance L2, the infrared light which passed through the path g5 among the infrared light

emitted from the light emitting device 106 will reflect with the reflective spot p1 of a guard plate 120, and there is not only a problem that an installation tooth space becomes large, but it will carry out incidence to a photo detector 110 through a path g6. For this reason, although there was no detection object T into the sensing area R3, there was a problem of detecting the detection object T accidentally.

[0008] This invention solves the problem of the above-mentioned Prior art, and it aims at offering the toilet bowl using the infrared reflective type sensor and this which raised the detection precision of a detection object while it can detect the detection object in the location close to a light emitting device and a photo detector.

[0009]

[The means for solving a technical problem, and its operation and effectiveness]

Invention of claim 1 made in order to solve the above-mentioned technical problem The light emitting device which emits infrared light, and the photo detector left and installed from this light emitting device, It has a protection member for consisting of an ingredient of light transmission nature, being separated and installed from a photo detector and a light emitting device, and protecting this photo detector and a light emitting device. By receiving the reflected light reflected with the detection object among the infrared light which was emitted from the above-mentioned light emitting device, and passed along the protection member by the above-mentioned photo detector In the infrared reflective type sensor which detects this detection object the above-mentioned light emitting device It is arranged so that the floodlighting area where the infrared light which spreads in the range of the 1st include angle from the core is emitted may be formed. The above-mentioned photo detector While forming the light-receiving area which receives the infrared light of the range of the 2nd include angle from the core The field with which this light-receiving area and the above-mentioned floodlighting area lap is made into sensing area, and it is arranged so that the reflected light may be received, when the above-mentioned detection object is in this sensing area. The above-mentioned protection member It has the transparency section which the infrared light emitted from the above-mentioned light emitting device penetrates, and this transparency section is characterized by being constituted so that the infrared light reflected in this transparency section may not go to the above-mentioned photo detector side while it is arranged so that the part may enter in the above-mentioned sensing area at least.

[0010] In the 1st invention, a light emitting device emits infrared light in the range of the 1st include angle from the core, it is arranged so that the range may be made into floodlighting area, and the photo detector is arranged so that the light-receiving area which receives the infrared light of the range of the 2nd include angle from the core may be formed. And if the range with which floodlighting area and light-receiving area lap serves as sensing area and a detection object is in this sensing area, the infrared light emitted by the light emitting device will be reflected irregularly with a detection object, and will be received by the photo detector. Thereby, a detection object is detected.

[0011] Moreover, although the protection member separated, has been arranged from the light emitting device and the photo detector and has protected the light emitting device and the photo detector, since it is formed with the ingredient of light transmission nature, it does not serve as hindrance of detection of the detection object for letting the infrared light from a light emitting device pass. Moreover, since the protection member is arranged so that a part of sensing area may be started, even if a detection object is in the

location close to this protection member, it can detect this.

[0012] Furthermore, a protection member is equipped with the transparency section which the infrared light emitted from a light emitting device penetrates, and this transparency section is formed so that the infrared light reflected in this transparency section may not go to a photo detector. Therefore, since the infrared light which the infrared light emitted from the light emitting device did not reflect in the transparency section, that is, was reflected except the detection object does not enter by the photo detector, the detection signal which was mistaken from the photo detector is not outputted.

[0013] In addition, as a suitable mode of the transparency section of a protection member, a protection member is formed by the plate and it can realize by considering this protection member as the configuration installed in the inclined include angle.

[0014] Moreover, the front face of the transparency section is formed in a semi-sphere side focusing on a light emitting device as other suitable modes of the transparency section. Thereby, the infrared light reflected on the front face of the transparency section does not go to a return and photo detector side to a light emitting device.

[0015] The 2nd invention prepares the filler formed from the ingredient of the almost same refractive index as the transparency section between the transparency section of a protection member, and a light emitting device, and since the filler has the almost same refractive index as the transparency section, it does not produce the detection result made the mistake in reflection not producing on the front face of the transparency section, and following on the effect.

[0016] In addition, although the infrared reflective type sensor concerning this invention is applicable to various kinds of things, it can be used for the taking-a-seat sensor which outputs the detecting signal for controlling the jet command of the wash water, for example in the health washing station which spouts wash water towards the part of the body. Since the protection member is used in order to prevent contact on the body, this taking-a-seat sensor is suitably applicable.

[0017]

[Embodiment of the Invention] In order to clarify further a configuration and an operation of this invention explained above, the suitable example of this invention is explained below.

[0018] Drawing 1 is the external view of the foreign style toilet bowl with a health washing station which used the infrared reflective type sensor concerning the gestalt of 1 operation of this invention as a taking-a-seat sensor. As shown in drawing 1, the foreign style toilet bowl 11 is equipped with the health washing station 10, and it is equipped with the case body 12, the control unit 13 prepared in the housing part of the case body 12, the seat 15 and the toilet lid 16 which were supported by the case body 12 free [ rotation ], and the nozzle 18 for washing which carries out the discharged water of the warm water.

[0019] Moreover, the taking-a-seat sensor 20 is attached in the inside section of the case body 12 of the health washing station 10. This taking-a-seat sensor 20 is an infrared reflective type sensor, and when people sit down to the seat 15, it outputs a detection signal. This detection signal is used as a signal with which jet of wash water is permitted from the nozzle 18 for washing.

[0020] The outline block diagram in which drawing 2 shows the taking-a-seat sensor 20,

drawing 3 , and drawing 4 are the explanatory views explaining the detection actuation. In drawing 2 , the taking-a-seat sensor 20 is considering the sensor substrate 21, the light emitting device 22, the photo detector 23, and the guard plate 24 as main configurations. The receipt hollow 26 and the receipt hollow 27 are formed in the sensor substrate 21, a light emitting device 22 is installed in the above-mentioned receipt hollow 26, and the photo detector 23 is installed in the above-mentioned receipt hollow 27.

[0021] The above-mentioned receipt hollow 26 is almost parallel to a guard plate 24, and inclines by include-angle  $\theta_{26}$  to base 21a of the sensor substrate 21 while it is formed more deeply than the receipt hollow 27. [ of opening 26a of this receipt hollow 26 and opening 27a of the receipt hollow 27 ]

[0022] Moreover, the above-mentioned guard plate 24 is the plate of the light transmission nature which consists of acrylic resin, it serves as a smooth field so that scattered reflection of the infrared light from a light emitting device 22 may not be carried out, and it has the transparency section 25 which infrared light penetrates.

[0023] In the above-mentioned taking-a-seat sensor 20, the floodlighting area R1 where a light emitting device 22 emits infrared light is range which spreads in opening 26a to include-angle  $\theta_{26}$  centering on the central point Cpa of a light emitting device 22, and, on the other hand, the light-receiving area R2 which a photo detector 23 receives is range which spreads in include-angle  $\theta_{27}$  from opening 27a focusing on the point Cpb of a photo detector 23. And the range with which the floodlighting area R1 and the light-receiving area R2 lap is expressed in the sensing area R3 expressed with the broken line of drawing 2 . The above-mentioned guard plate 24 is arranged so that a part of sensing area R3 may be included.

[0024] Drawing 5 is the block diagram showing the detecting circuit 30 of the taking-a-seat sensor 20. In drawing 5 , actuation of the detecting circuit 30 of the taking-a-seat sensor 20 is explained. Now, power is supplied to a light emitting device 22 continuously or periodically from the drive circuit 31, and infrared light is emitted from a light emitting device 22. If the detection object T is in the sensing area R3 (refer to drawing 2 ) at this time, it will reflect and incidence of the infrared light will be carried out to a photo detector 23. A photo detector 23 outputs a feeble electrical signal according to the intensity of light by which incidence was carried out. This electrical signal is amplified in an amplifying circuit 32, and is inputted into one input terminal of a comparator 33. The reference voltage of the reference voltage circuit 34 is inputted into the other-end child of a comparator 33. A comparator 33 is outputting a high-level signal, when a detection signal exceeds the above-mentioned reference voltage, and it detects the detection object T.

[0025] Next, the detection actuation by the taking-a-seat sensor 20 is explained. In drawing 3 , if the detection object T1 is in the sensing area R3, the infrared light from a light emitting device 22 is reflected irregularly with the detection object T1, and a part of the reflected lights will go into a photo detector 23, and it will be changed into an electrical signal by the photo detector 23. The electrical signal from a photo detector 23 is electrically processed by the detecting circuit 30 explained by drawing 5 , and the detection object T1 is detected.

[0026] Moreover, it is arranged so that a guard plate 24 may cross a part of sensing area R3, and the location close to a guard plate 24 also serves as the sensing area R3. Therefore, the so-called near-point detection in which the detection object T2 is located

near a guard plate 24 can also be performed.

[0027] Next, the effect of the detection actuation accompanying the infrared light from a light emitting device 22 reflecting with a guard plate 24 is explained. In drawing 4, the infrared light emitted from a light emitting device 22 is reflected in the reflector F1 which overlaps the floodlighting area R1 among internal-surface 25a on a guard plate 24. The point P1 near a photo detector 23 serves as the path G1 which approaches a light emitting device 22 most among this reflector F1. Here, supposing internal-surface 25a of a guard plate 24 is fully smooth and it does not reflect it irregularly, it will reflect the infrared light which passed through the path G1 to the normal La in a point P1 by angle-of-reflection  $\theta_{out1}$  equal to incident angle  $\theta_{in1}$ .

[0028] Here, a guard plate 24 inclines by include-angle  $\theta_k$ , and angle-of-reflection  $\theta_{out1}$  is arranged so that the include angle  $\alpha_1$  of a path G1 and a reflector F1 to make may become 90 degrees or more, so that the direction left to a photo detector 23 may serve as forward that is,.

[0029] Therefore, the infrared light reflected the point P1 on a reflector F1 goes in the direction distant from the photo detector 23. If similarly infrared light reflects through a path G2 at the point P2 in the reflector F1 distant from the photo detector 23, since an include angle  $\alpha_2$  becomes larger than 90 degrees, it will go in the direction further distant to the photo detector 23. Thus, the infrared light emitted from the light emitting device 22 does not perform detection actuation which was mistaken toward the photo detector 23. In addition, since the reflection in outside-surface 25b of a guard plate 24 is the same as internal-surface 25a, the effect does not exist.

[0030] Drawing 6 is the block diagram showing taking-a-seat sensor 20B concerning the gestalt of the 2nd operation. In drawing 6, taking-a-seat sensor 20B is the same configuration as the gestalt of the 1st operation except the point that the configurations of sensor substrate 21B and guard-plate 24B differ. That is, in sensor substrate 21B, receipt hollow 26B which contains a light emitting device 22, and receipt hollow 27B which contains a photo detector 23 are the same configurations, that is, the configuration of the depth of receipt hollow 26B and receipt hollow 27B, opening 26Ba, and opening 27Ba is the same, and has become the symmetry focusing on the septum section 28 in the meantime. Of such a configuration of taking-a-seat sensor 20B, the floodlighting area R1 and the light-receiving area R2 are the configurations same at include-angle  $\theta_{aa}$ , and the sensing area R3 is formed in the center section of the floodlighting area R1 and the light-receiving area R2.

[0031] Moreover, the above-mentioned guard-plate 24B is arranged in parallel with base 21a of sensor substrate 21B. It is the part which counters a light emitting device 22 among the above-mentioned guard-plate 24B, and the part which laps with the sensing area R3 has become transparency section 25B. That is, internal-surface 25Ba of transparency section 25B and outside-surface 25Bb are the semi-sphere side which carried out the core of the central point Cpa of a light emitting device 22.

[0032] Next, detection actuation of taking-a-seat sensor 20B is explained. In drawing 7, if the detection object T1 is in the sensing area R3, as path G3 shows, after it penetrates transparency section 25 of guard-plate 24B, the infrared light from a light emitting device 22 is reflected irregularly on the front face of the detection object T1, and again, it will pass guard-plate 24B and it will carry out incidence to a photo detector 23. Thereby, the detection object T is detected by taking-a-seat sensor 20B.

[0033] Thus, although the infrared light from a light emitting device 22 goes transparency section 25 of guard-plate 24B straight on, as shown in drawing 8, the part reflects by internal-surface 25Ba of guard-plate 24B. However, since internal-surface 25Ba of transparency section 25B is a semi-sphere side centering on the central point Cpa of a light emitting device 22, all the reflected lights reflected by transparency section 25B go to a light emitting device 22. Therefore, the reflected light reflected by guard-plate 24B does not produce the detection result which incidence is not carried out to a photo detector 23, and was mistaken.

[0034] In addition, although transparency section 25 of guard-plate 24B was formed in the semi-sphere side with the gestalt of the 2nd operation explained using drawing 6 etc., you may be taking-a-seat sensor 20C concerning the gestalt of the 3rd operation shown not only in this but in drawing 9. That is, since what is necessary is just to make it reflect so that the reflected light may not be made to go to a photo detector 23, transparency section 25C of guard-plate 24C of taking-a-seat sensor 20C is good only also considering the part by the side of the photo detector 23 of transparency section 25C as the shape of the spherical surface.

[0035] Next, taking-a-seat sensor 20D shown in drawing 10 and drawing 11 concerning the gestalt of the 4th operation is explained. In drawing 10, although sensor substrate 21D of taking-a-seat sensor 20D is the same as the gestalt of the 2nd operation of drawing 6, the configurations of guard-plate 24D differ. That is, guard-plate 24D differs in the configuration of transparency section 25D while the board thickness tD makes it thicker than guard-plate 24B of drawing 6 and enlarges the magnitude of attenuation of infrared light. That is, using the acrylic board of a little thicker light transmission nature, guard-plate 24D cuts internal-surface 25Da of transparency section 25D, and is taken as the semi-sphere side-like concave surface.

[0036] Here, since detection actuation of a detection object is the same as the gestalt of the 1st operation mentioned above, the effect of reflective by guard-plate 24D is explained. In internal-surface 25Da of guard-plate 24D, incidence of the infrared light from a light emitting device 22 is not altogether carried out toward a light emitting device 22 to a photo detector 23. On the other hand, in outside-surface 25Db of guard-plate 24D, a part of infrared light from a light emitting device 22 reflects, and it goes to a photo detector 23. However, since the paths u1 and u2 are long when paths u1 and u2 are passed within guard-plate 24D, the magnitude of attenuation of infrared light is large, and the quantity of light which goes to a photo detector 23 becomes very small. Therefore, there is no effect of the reflected light by outside-surface 25Db of guard-plate 24D. In addition, since the quantity of light of infrared light reflected from a detection object is larger than the quantity of light reflected by outside-surface 25Db of transparency section 25D, there is no trouble in the detection actuation accompanying attenuation of transparency section 25D.

[0037] Next, taking-a-seat sensor 20E shown in drawing 12 and drawing 13 concerning the gestalt of the 5th operation is explained. In drawing 12, taking-a-seat sensor 20E differs from the gestalt of operation which the configuration which filled up the tooth space between the configuration of guard-plate 24E, and sensor substrate 21E and guard-plate 24E with the filler 29 mentioned above. That is, outside-surface 25Eb of transparency section 25E of guard-plate 24E has become semi-sphere-like. Moreover, the above-mentioned filler 29 is formed from the ingredient (for example, acrylic resin,) of



the light transmission nature of the same refractive index as guard-plate 24E.

[0038] According to the above-mentioned taking-a-seat sensor 20E, since outside-surface 25Eb of transparency section 25E serves as a semi-sphere side centering on the central point Cpa of a light emitting device 22 and the reflected light in the outside-surface 25Db does not go to a photo detector 23 toward a light emitting device 22 altogether, there is no effect of reflective by outside-surface 25Eb of transparency section 25E.

[0039] On the other hand, the tooth space by the side of internal-surface 25Ea of transparency section 25E is filled up with the filler 29, and the ingredient of this filler 29 is an ingredient of the same refractive index as guard-plate 24E. For this reason, since infrared light does not reflect by internal-surface 25Ea of transparency section 25E and it does not go to a photo detector 23, that effect does not exist. In addition, all the tooth spaces of guard-plate 24E including a light emitting device 22 and a photo detector 23 are filled up with a filler 29, and also it may be filled up with it only around the path which goes to a photo detector 23.

[0040] In addition, this invention can be carried out in various modes in the range which is not restricted to the above-mentioned example and does not deviate from that summary.

## TECHNICAL FIELD

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[Field of the Invention] This invention relates to the toilet bowl using the infrared reflective type sensor and this which are used for the taking-a-seat sensor which detects the existence of taking a seat to a foreign style toilet bowl.

## PRIOR ART

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[Description of the Prior Art] It has conventionally the light emitting device which emits infrared light, and the photo detector which receives infrared light as this kind of an infrared reflective type sensor, the infrared light emitted from this light emitting device is reflected by the detection object, and the sensor which detects the existence of a detection object based on the detection signal of the photo detector which receives that reflected light is known (JP,6-101260,A).

[0003] Drawing 14 is the outline block diagram showing the infrared reflective type sensor 100. The infrared reflective type sensor 100 is equipped with casing 102, the light emitting device 106 contained by the receipt hollow 104 formed in this casing 102, the photo detector 110 contained by the receipt hollow 108 formed in the above-mentioned casing 102, and the guard plate 112 with which only distance L1 was detached and installed to casing 102 in drawing 14. The above-mentioned guard plate 112 is formed from the acrylic board of light transmission nature, and is aiming at protection of internal components, such as a light emitting device 106 and a photo detector 110, and improvement in an appearance.

[0004] By the above-mentioned infrared reflective type sensor 100, the range emitted at an include angle  $\theta_1$  focusing on a light emitting device 106 serves as the floodlighting area R1, and the range of the include angle  $\theta_2$  centering on a photo detector 110 serves as the light-receiving area R2. And if the field with which the floodlighting area R1 and the light-receiving area R2 lap is made into the sensing area R3 (part shown with a broken line) and the detection object T enters in the sensing area R3, the light from a light emitting device 106 will be reflected irregularly on the front face of the detection object T through a path g1, and will go into a photo detector 110 through a path g2. At this time, if the detection signal from a photo detector 110 becomes more than predetermined, it will have judged with there being a detection object T.

[0005] However, even if it is the infrared light which passes along a photo detector 110 by the above-mentioned infrared reflective type sensor 100 most among the infrared light from a light emitting device 106 when it is in the location where the detection object T approached the guard-plate 112 side from the sensing area R3, that is, separates from the sensing area R3, as shown in drawing 15, i.e., the infrared light which passes through a path g4 from a path g3, it cannot go into a photo detector 110 and the detection object T cannot be detected.

[0006] In order to solve this, as shown in drawing 16, a guard plate 120 is detached from a light emitting device 106 and a photo detector 110 to distance L2, and there is a means to arrange a guard plate 120 so that the sensing area R3 may be started.

## EFFECT OF THE INVENTION

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[The means for solving a technical problem, and its operation and effectiveness]

Invention of claim 1 made in order to solve the above-mentioned technical problem The light emitting device which emits infrared light, and the photo detector left and installed from this light emitting device, It has a protection member for consisting of an ingredient of light transmission nature, being separated and installed from a photo detector and a light emitting device, and protecting this photo detector and a light emitting device. By receiving the reflected light reflected with the detection object among the infrared light which was emitted from the above-mentioned light emitting device, and passed along the protection member by the above-mentioned photo detector In the infrared reflective type sensor which detects this detection object the above-mentioned light emitting device It is arranged so that the floodlighting area where the infrared light which spreads in the range of the 1st include angle from the core is emitted may be formed. The above-mentioned photo detector While forming the light-receiving area which receives the infrared light of the range of the 2nd include angle from the core The field with which this light-receiving area and the above-mentioned floodlighting area lap is made into sensing area, and it is arranged so that the reflected light may be received, when the above-mentioned detection object is in this sensing area. The above-mentioned protection member It has the transparency section which the infrared light emitted from the above-mentioned light emitting device penetrates, and this transparency section is characterized by being constituted so that the infrared light reflected in this transparency section may not go to the above-mentioned photo detector side while it is arranged so that the part may enter in the above-mentioned sensing area at least.

[0010] In the 1st invention, a light emitting device emits infrared light in the range of the 1st include angle from the core, it is arranged so that the range may be made into floodlighting area, and the photo detector is arranged so that the light-receiving area which receives the infrared light of the range of the 2nd include angle from the core may be formed. And if the range with which floodlighting area and light-receiving area lap serves as sensing area and a detection object is in this sensing area, the infrared light emitted by the light emitting device will be reflected irregularly with a detection object, and will be received by the photo detector. Thereby, a detection object is detected.

[0011] Moreover, although the protection member separated, has been arranged from the light emitting device and the photo detector and has protected the light emitting device and the photo detector, since it is formed with the ingredient of light transmission nature, it does not serve as hindrance of detection of the detection object for letting the infrared light from a light emitting device pass. Moreover, since the protection member is arranged so that a part of sensing area may be started, even if a detection object is in the location close to this protection member, it can detect this.

[0012] Furthermore, a protection member is equipped with the transparency section which the infrared light emitted from a light emitting device penetrates, and this transparency section is formed so that the infrared light reflected in this transparency section may not go to a photo detector. Therefore, since the infrared light which the infrared light emitted from the light emitting device did not reflect in the transparency section, that is, was reflected except the detection object does not enter by the photo detector, the detection signal which was mistaken from the photo detector is not

outputted.

[0013] In addition, as a suitable mode of the transparency section of a protection member, a protection member is formed by the plate and it can realize by considering this protection member as the configuration installed in the inclined include angle.

[0014] Moreover, the front face of the transparency section is formed in a semi-sphere side focusing on a light emitting device as other suitable modes of the transparency section. Thereby, the infrared light reflected on the front face of the transparency section does not go to a return and photo detector side to a light emitting device.

[0015] The 2nd invention prepares the filler formed from the ingredient of the almost same refractive index as the transparency section between the transparency section of a protection member, and a light emitting device, and since the filler has the almost same refractive index as the transparency section, it does not produce the detection result made the mistake in reflection not producing on the front face of the transparency section, and following on the effect.

[0016] In addition, although the infrared reflective type sensor concerning this invention is applicable to various kinds of things, it can be used for the taking-a-seat sensor which outputs the detecting signal for controlling the jet command of the wash water, for example in the health washing station which spouts wash water towards the part of the body. Since the protection member is used in order to prevent contact on the body, this taking-a-seat sensor is suitably applicable.

[0017]

[Embodiment of the Invention] In order to clarify further a configuration and an operation of this invention explained above, the suitable example of this invention is explained below.

[0018] Drawing 1 is the external view of the foreign style toilet bowl with a health washing station which used the infrared reflective type sensor concerning the gestalt of 1 operation of this invention as a taking-a-seat sensor. As shown in drawing 1, the foreign style toilet bowl 11 is equipped with the health washing station 10, and it is equipped with the case body 12, the control unit 13 prepared in the housing part of the case body 12, the seat 15 and the toilet lid 16 which were supported by the case body 12 free [ rotation ], and the nozzle 18 for washing which carries out the discharged water of the warm water.

[0019] Moreover, the taking-a-seat sensor 20 is attached in the inside section of the case body 12 of the health washing station 10. This taking-a-seat sensor 20 is an infrared reflective type sensor, and when people sit down to the seat 15, it outputs a detection signal. This detection signal is used as a signal with which jet of wash water is permitted from the nozzle 18 for washing.

[0020] The outline block diagram in which drawing 2 shows the taking-a-seat sensor 20, drawing 3, and drawing 4 are the explanatory views explaining the detection actuation. In drawing 2, the taking-a-seat sensor 20 is considering the sensor substrate 21, the light emitting device 22, the photo detector 23, and the guard plate 24 as main configurations. The receipt hollow 26 and the receipt hollow 27 are formed in the sensor substrate 21, a light emitting device 22 is installed in the above-mentioned receipt hollow 26, and the photo detector 23 is installed in the above-mentioned receipt hollow 27.

[0021] The above-mentioned receipt hollow 26 is almost parallel to a guard plate 24, and inclines by include-angle  $\theta$  to base 21a of the sensor substrate 21 while it is formed

more deeply than the receipt hollow 27. [ of opening 26a of this receipt hollow 26 and opening 27a of the receipt hollow 27 ]

[0022] Moreover, the above-mentioned guard plate 24 is the plate of the light transmission nature which consists of acrylic resin, it serves as a smooth field so that scattered reflection of the infrared light from a light emitting device 22 may not be carried out, and it has the transparency section 25 which infrared light penetrates.

[0023] In the above-mentioned taking-a-seat sensor 20, the floodlighting area R1 where a light emitting device 22 emits infrared light is range which spreads in opening 26a to include-angle  $\theta_a$  centering on the central point Cpa of a light emitting device 22, and, on the other hand, the light-receiving area R2 which a photo detector 23 receives is range which spreads in include-angle  $\theta_b$  from opening 27a focusing on the point Cpb of a photo detector 23. And the range with which the floodlighting area R1 and the light-receiving area R2 lap is expressed in the sensing area R3 expressed with the broken line of drawing 2 . The above-mentioned guard plate 24 is arranged so that a part of sensing area R3 may be included.

[0024] Drawing 5 is the block diagram showing the detecting circuit 30 of the taking-a-seat sensor 20. In drawing 5 , actuation of the detecting circuit 30 of the taking-a-seat sensor 20 is explained. Now, power is supplied to a light emitting device 22 continuously or periodically from the drive circuit 31, and infrared light is emitted from a light emitting device 22. If the detection object T is in the sensing area R3 (refer to drawing 2 ) at this time, it will reflect and incidence of the infrared light will be carried out to a photo detector 23. A photo detector 23 outputs a feeble electrical signal according to the intensity of light by which incidence was carried out. This electrical signal is amplified in an amplifying circuit 32, and is inputted into one input terminal of a comparator 33. The reference voltage of the reference voltage circuit 34 is inputted into the other-end child of a comparator 33. A comparator 33 is outputting a high-level signal, when a detection signal exceeds the above-mentioned reference voltage, and it detects the detection object T.

[0025] Next, the detection actuation by the taking-a-seat sensor 20 is explained. In drawing 3 , if the detection object T1 is in the sensing area R3, the infrared light from a light emitting device 22 is reflected irregularly with the detection object T1, and a part of the reflected lights will go into a photo detector 23, and it will be changed into an electrical signal by the photo detector 23. The electrical signal from a photo detector 23 is electrically processed by the detecting circuit 30 explained by drawing 5 , and the detection object T1 is detected.

[0026] Moreover, it is arranged so that a guard plate 24 may cross a part of sensing area R3, and the location close to a guard plate 24 also serves as the sensing area R3. Therefore, the so-called near-point detection in which the detection object T2 is located near a guard plate 24 can also be performed.

[0027] Next, the effect of the detection actuation accompanying the infrared light from a light emitting device 22 reflecting with a guard plate 24 is explained. In drawing 4 , the infrared light emitted from a light emitting device 22 is reflected in the reflector F1 which overlaps the floodlighting area R1 among internal-surface 25a on a guard plate 24. The point P1 near a photo detector 23 serves as the path G1 which approaches a light emitting device 22 most among this reflector F1. Here, supposing internal-surface 25a of a guard plate 24 is fully smooth and it does not reflect it irregularly, it will reflect the infrared

light which passed through the path G1 to the normal La in a point P1 by angle-of-reflection  $\theta_{out1}$  equal to incident angle  $\theta_{in1}$ .

[0028] Here, a guard plate 24 inclines by include-angle  $\theta_{tak}$ , and angle-of-reflection  $\theta_{out1}$  is arranged so that the include angle  $\alpha_1$  of a path G1 and a reflector F1 to make may become 90 degrees or more, so that the direction left to a photo detector 23 may serve as forward that is,

[0029] Therefore, the infrared light reflected the point P1 on a reflector F1 goes in the direction distant from the photo detector 23. If similarly infrared light reflects through a path G2 at the point P2 in the reflector F1 distant from the photo detector 23, since an include angle  $\alpha_2$  becomes larger than 90 degrees, it will go in the direction further distant to the photo detector 23. Thus, the infrared light emitted from the light emitting device 22 does not perform detection actuation which was mistaken toward the photo detector 23. In addition, since the reflection in outside-surface 25b of a guard plate 24 is the same as internal-surface 25a, the effect does not exist.

[0030] Drawing 6 is the block diagram showing taking-a-seat sensor 20B concerning the gestalt of the 2nd operation. In drawing 6, taking-a-seat sensor 20B is the same configuration as the gestalt of the 1st operation except the point that the configurations of sensor substrate 21B and guard-plate 24B differ. That is, in sensor substrate 21B, receipt hollow 26B which contains a light emitting device 22, and receipt hollow 27B which contains a photo detector 23 are the same configurations, that is, the configuration of the depth of receipt hollow 26B and receipt hollow 27B, opening 26Ba, and opening 27Ba is the same, and has become the symmetry focusing on the septum section 28 in the meantime. Of such a configuration of taking-a-seat sensor 20B, the floodlighting area R1 and the light-receiving area R2 are the configurations same at include-angle  $\theta_{taa}$ , and the sensing area R3 is formed in the center section of the floodlighting area R1 and the light-receiving area R2.

[0031] Moreover, the above-mentioned guard-plate 24B is arranged in parallel with base 21a of sensor substrate 21B. It is the part which counters a light emitting device 22 among the above-mentioned guard-plate 24B, and the part which laps with the sensing area R3 has become transparency section 25B. That is, internal-surface 25Ba of transparency section 25B and outside-surface 25Bb are the semi-sphere side which carried out the core of the central point Cpa of a light emitting device 22.

[0032] Next, detection actuation of taking-a-seat sensor 20B is explained. In drawing 7, if the detection object T1 is in the sensing area R3, as path G3 shows, after it penetrates transparency section 25 of guard-plate 24B, the infrared light from a light emitting device 22 is reflected irregularly on the front face of the detection object T1, and again, it will pass guard-plate 24B and it will carry out incidence to a photo detector 23. Thereby, the detection object T is detected by taking-a-seat sensor 20B.

[0033] Thus, although the infrared light from a light emitting device 22 goes transparency section 25 of guard-plate 24B straight on, as shown in drawing 8, the part reflects by internal-surface 25Ba of guard-plate 24B. However, since internal-surface 25Ba of transparency section 25B is a semi-sphere side centering on the central point Cpa of a light emitting device 22, all the reflected lights reflected by transparency section 25B go to a light emitting device 22. Therefore, the reflected light reflected by guard-plate 24B does not produce the detection result which incidence is not carried out to a photo detector 23, and was mistaken.

[0034] In addition, although transparency section 25 of guard-plate 24B B was formed in the semi-sphere side with the gestalt of the 2nd operation explained using drawing 6 etc., you may be taking-a-seat sensor 20C concerning the gestalt of the 3rd operation shown not only in this but in drawing 9 . That is, since what is necessary is just to make it reflect so that the reflected light may not be made to go to a photo detector 23, transparency section 25C of guard-plate 24C of taking-a-seat sensor 20C is good only also considering the part by the side of the photo detector 23 of transparency section 25C as the shape of the spherical surface.

[0035] Next, taking-a-seat sensor 20D shown in drawing 10 and drawing 11 concerning the gestalt of the 4th operation is explained. In drawing 10 , although sensor substrate 21D of taking-a-seat sensor 20D is the same as the gestalt of the 2nd operation of drawing 6 , the configurations of guard-plate 24D differ. That is, guard-plate 24D differs in the configuration of transparency section 25D while the board thickness tD makes it thicker than guard-plate 24B of drawing 6 and enlarges the magnitude of attenuation of infrared light. That is, using the acrylic board of a little thicker light transmission nature, guard-plate 24D cuts internal-surface 25Da of transparency section 25D, and is taken as the semi-sphere side-like concave surface.

[0036] Here, since detection actuation of a detection object is the same as the gestalt of the 1st operation mentioned above, the effect of reflective by guard-plate 24D is explained. In internal-surface 25Da of guard-plate 24D, incidence of the infrared light from a light emitting device 22 is not altogether carried out toward a light emitting device 22 to a photo detector 23. On the other hand, in outside-surface 25Db of guard-plate 24D, a part of infrared light from a light emitting device 22 reflects, and it goes to a photo detector 23. However, since the paths u1 and u2 are long when paths u1 and u2 are passed within guard-plate 24D, the magnitude of attenuation of infrared light is large, and the quantity of light which goes to a photo detector 23 becomes very small. Therefore, there is no effect of the reflected light by outside-surface 25Db of guard-plate 24D. In addition, since the quantity of light of infrared light reflected from a detection object is larger than the quantity of light reflected by outside-surface 25Db of transparency section 25D, there is no trouble in the detection actuation accompanying attenuation of transparency section 25D.

[0037] Next, taking-a-seat sensor 20E shown in drawing 12 and drawing 13 concerning the gestalt of the 5th operation is explained. In drawing 12 , taking-a-seat sensor 20E differs from the gestalt of operation which the configuration which filled up the tooth space between the configuration of guard-plate 24E, and sensor substrate 21E and guard-plate 24E with the filler 29 mentioned above. That is, outside-surface 25Eb of transparency section 25E of guard-plate 24E has become semi-sphere-like. Moreover, the above-mentioned filler 29 is formed from the ingredient (for example, acrylic resin, ) of the light transmission nature of the same refractive index as guard-plate 24E.

[0038] According to the above-mentioned taking-a-seat sensor 20E, since outside-surface 25Eb of transparency section 25E serves as a semi-sphere side centering on the central point Cpa of a light emitting device 22 and the reflected light in the outside-surface 25Db does not go to a photo detector 23 toward a light emitting device 22 altogether, there is no effect of reflective by outside-surface 25Eb of transparency section 25E.

[0039] On the other hand, the tooth space by the side of internal-surface 25Ea of transparency section 25E is filled up with the filler 29, and the ingredient of this filler 29

is an ingredient of the same refractive index as guard-plate 24E. For this reason, since infrared light does not reflect by internal-surface 25Ea of transparency section 25E and it does not go to a photo detector 23, that effect does not exist. In addition, all the tooth spaces of guard-plate 24E including a light emitting device 22 and a photo detector 23 are filled up with a filler 29, and also it may be filled up with it only around the path which goes to a photo detector 23.

[0040] In addition, this invention can be carried out in various modes in the range which is not restricted to the above-mentioned example and does not deviate from that summary.

#### TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, if a guard plate 120 is made far to distance L2, the infrared light which passed through the path g5 among the infrared light emitted from the light emitting device 106 will reflect with the reflective spot p1 of a guard plate 120, and there is not only a problem that an installation tooth space becomes large, but it will carry out incidence to a photo detector 110 through a path g6. For this reason, although there was no detection object T into the sensing area R3, there was a problem of detecting the detection object T accidentally.

[0008] This invention solves the problem of the above-mentioned Prior art, and it aims at offering the toilet bowl using the infrared reflective type sensor and this which raised the detection precision of a detection object while it can detect the detection object in the location close to a light emitting device and a photo detector.

#### DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The perspective view showing the health washing station 10 which used the infrared reflective type sensor concerning the gestalt of 1 operation of this invention for the taking-a-seat sensor 20.

[Drawing 2] The explanatory view explaining the taking-a-seat sensor 20 concerning the gestalt of the 1st operation.

[Drawing 3] The explanatory view explaining detection actuation of the taking-a-seat sensor 20.

[Drawing 4] The explanatory view explaining the effect of the reflected light of a guard plate 24.

[Drawing 5] The block diagram explaining the detecting circuit 30 of the taking-a-seat sensor 20.

[Drawing 6] The explanatory view explaining taking-a-seat sensor 20B concerning the gestalt of the 2nd operation.

[Drawing 7] The explanatory view explaining detection actuation of taking-a-seat sensor 20B.

[Drawing 8] The explanatory view explaining the effect of the reflected light of guard-plate 24B.

[Drawing 9] The explanatory view explaining taking-a-seat sensor 20C concerning the gestalt of the 3rd operation.

[Drawing 10] The explanatory view explaining taking-a-seat sensor 20D concerning the gestalt of the 4th operation.



[Drawing 11] The explanatory view explaining the effect of the reflected light of guard-plate 24D.

[Drawing 12] The explanatory view explaining taking-a-seat sensor 20E concerning the gestalt of the 5th operation.

[Drawing 13] The explanatory view explaining the effect of the reflected light of guard-plate 24E.

[Drawing 14] The explanatory view explaining the conventional infrared reflective type sensor 100.

[Drawing 15] The explanatory view explaining the technical problem of the infrared reflective type sensor 100.

[Drawing 16] The explanatory view explaining other conventional infrared reflective type sensor 100P.

[Description of Notations]

T, T1, T2 -- Detection object

F1 -- Reflector

R1 -- Floodlighting area

R2 -- Light-receiving area

R3 -- Sensing area

10 -- Health washing station

11 -- Foreign style toilet bowl

12 -- Case body

13 -- Control unit

15 -- Seat

16 -- Toilet lid

18 -- Nozzle for washing

20 -- Taking-a-seat sensor

20, 20B-20E -- Taking-a-seat sensor

21, 21B-21E -- Sensor substrate

21a -- Base

22 -- Light emitting device

23 -- Photo detector

24, 24B-24E -- Guard plate

25, 25B-25E -- Transparency section

25a, 25Ba, 25Da, 25Ea -- Internal surface

25b, 25Bb, 25Db, 25Eb -- Outside surface

26 26B -- Receipt hollow

26a, 26Ba -- Opening

27 27B -- Receipt hollow

27a, 27Ba -- Opening

28 -- Septum section

29 -- Filler

30 -- Detecting circuit

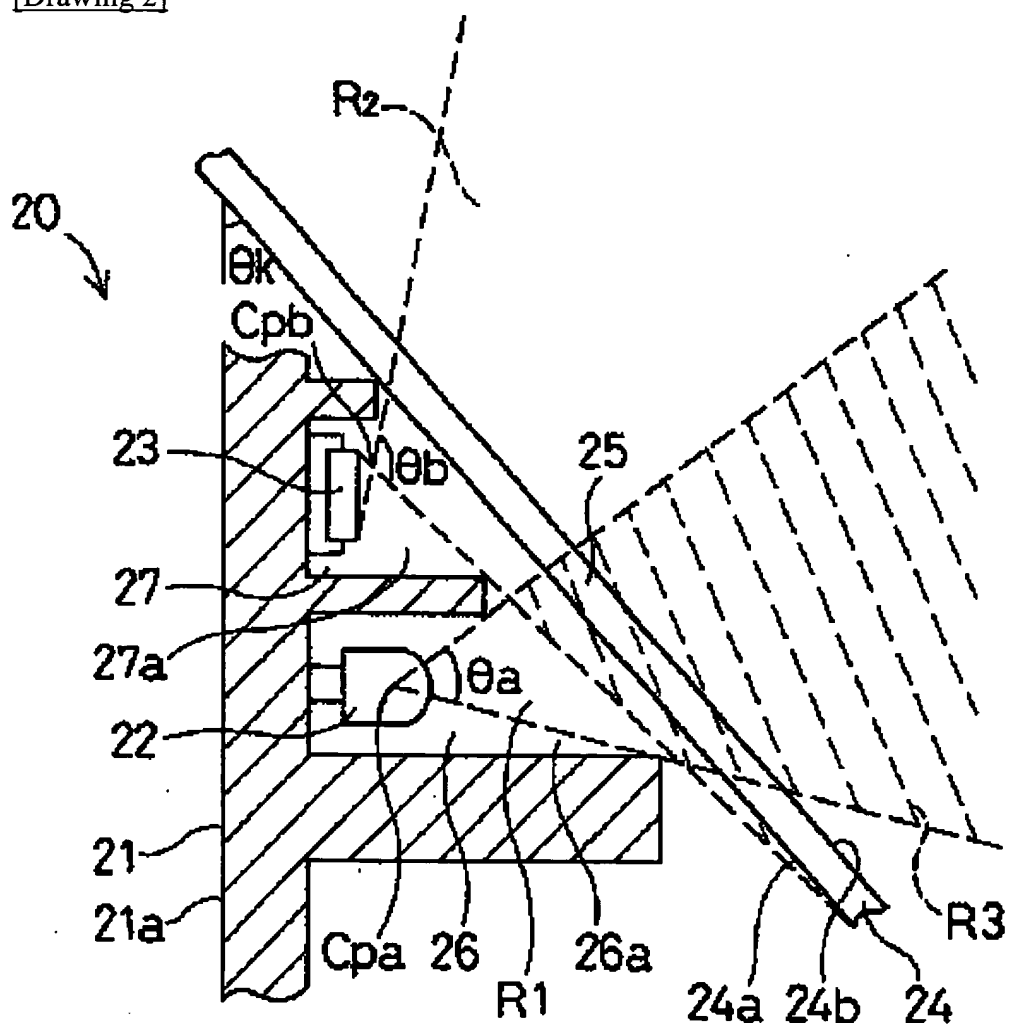
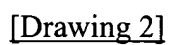
31 -- Drive circuit

32 -- Amplifying circuit

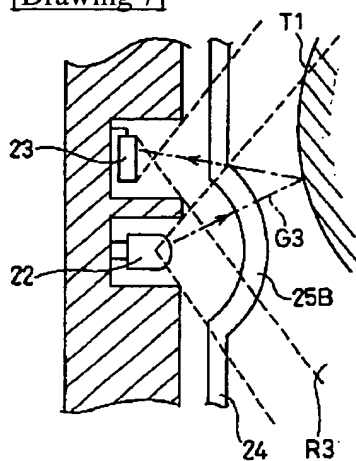
33 -- Comparator

34 -- Reference voltage circuit

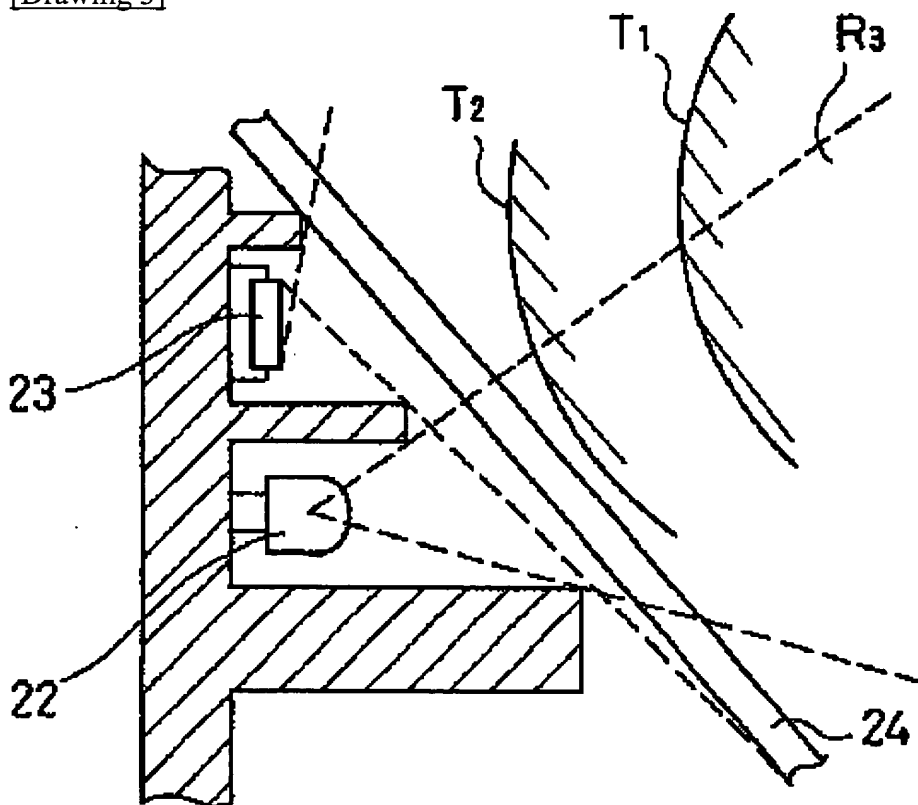
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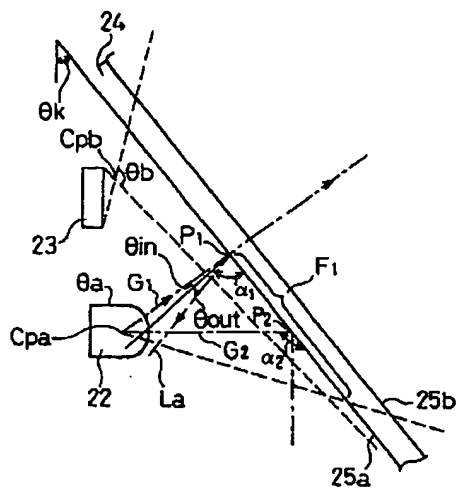
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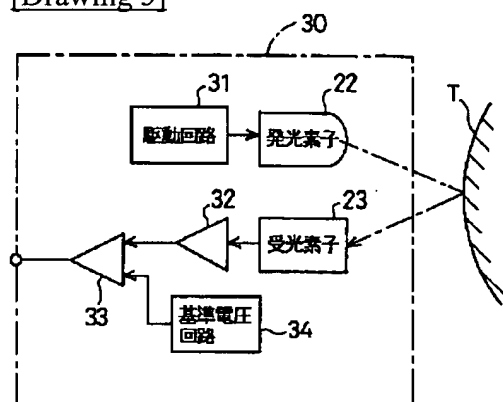
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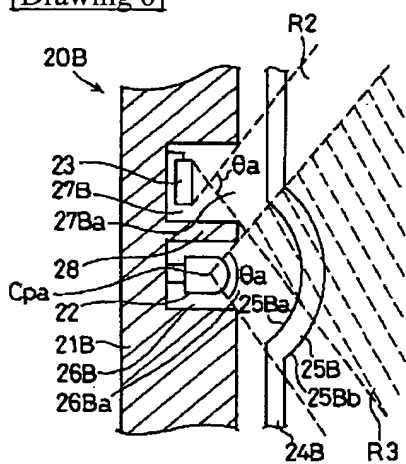
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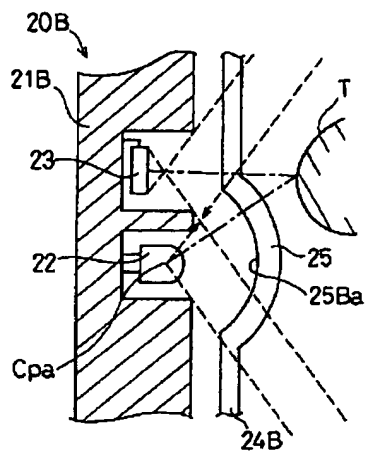
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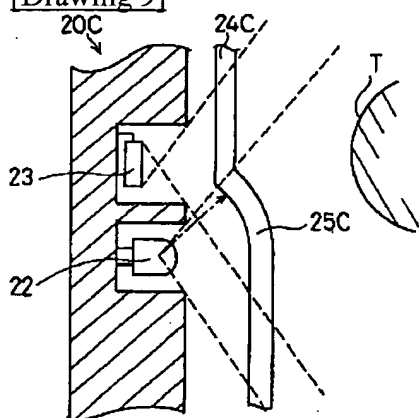
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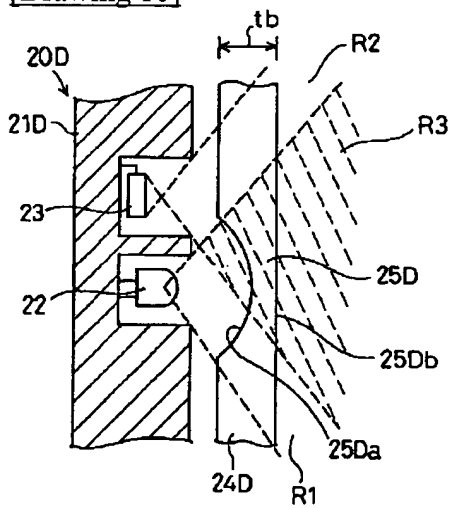
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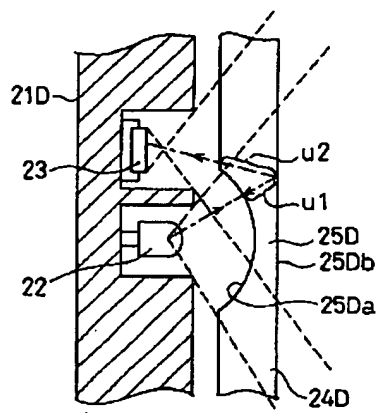
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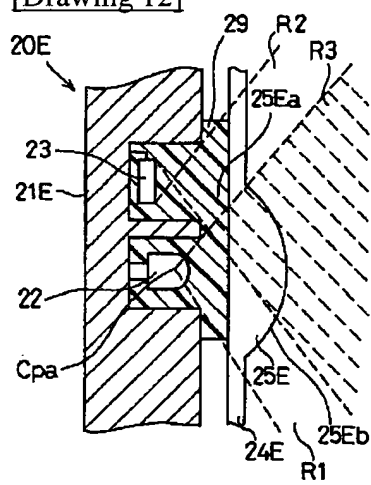
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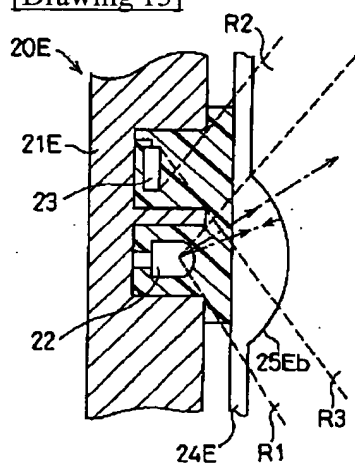
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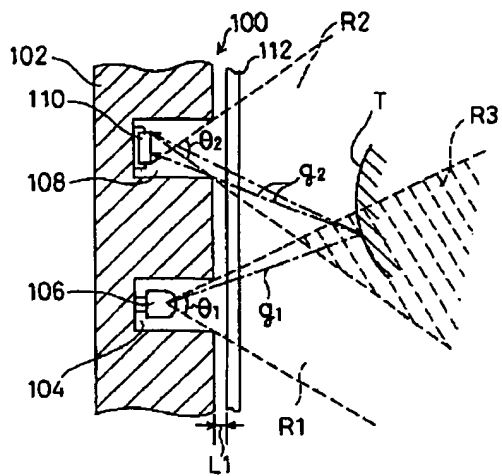
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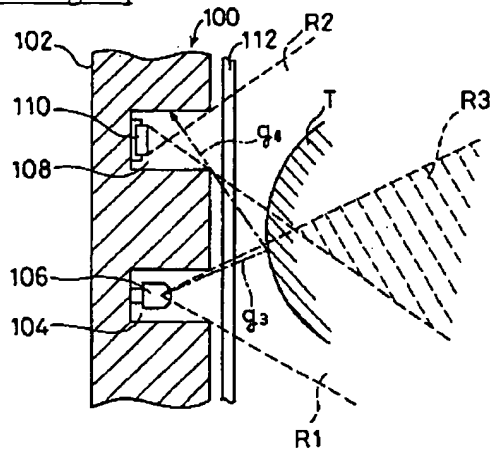
[Drawing 13]



[Drawing 14]



[Drawing 15]



[Drawing 16]

